Claims

1. A battery separator comprising at least one fibrous layer and at least one support layer, wherein said support layer is formed of an acid-resistant material and comprises a plurality of macroscopic openings.

2. A battery separator according to claim 1, wherein the fibrous layer has an average pore size of 3 to 15 μm.

3. A battery separator according to claim 1, wherein the fibrous layers essentially consist of glass fibers.

4. A battery separator according to claim 3, wherein the fibrous layers comprise 20 to 40 % by weight of glass microfibers having an average diameter of less than 1 μm and 60 to 80 % by weight of coarse glass fibers having an average diameter of about 3 μm.

5. A battery separator according to claim 1, wherein the fibrous layers essentially consist of polymeric fibers.

6. A battery separator according to claim 5, wherein the fibrous layers comprise polymeric fibers having a diameter of 0.1 to 10 μm.

7. A battery separator according to claim 6, wherein at least 10 % by weight of the polymeric fibers of the fibrous layers have diameters of less than 1 μm and at least 60 % by weight of the polymeric fibers have diameters of less than 5 μm.

8. A battery separator according to claim 7, wherein at least 15 % by weight of the polymeric fibers have diameters of less than 1 μm.

9. A battery separator according to claim 8, wherein the fibrous layers comprise 20 to 40 % by weight of polymeric microfibers having an average diameter of less than 1 µm.

10. A battery separator according to claim 6, wherein the polymeric fibers have diameters ranging from 0.1 to 5 µm.

11. A battery separator according to claim 5, wherein the polymeric fibers are polyolefin fibers.

12. A battery separator according to claim 11, wherein the polyolefin is polyethylene and/or polypropylene.

13. A battery separator according to claim 1, wherein the fibrous layers comprise a mixture of glass fibers and polymeric fibers.

14. A battery separator according to claim 13, wherein the fibrous layers comprise glass fibers having a diameter of 0.1 to 10 µm.

15. A battery separator according to claim 14, wherein the glass fibers have diameters ranging from 0.1 to 5 µm.

16. A battery separator according to claim 13, wherein the fibrous layers comprise polymeric fibers having a diameter of 0.1 to 10 µm.

17. A battery separator according to claim 16, wherein the polymeric fibers have diameters ranging from 0.1 to 5 µm.

18. A battery separator according to claim 13, wherein the polymeric fibers are polyolefin fibers.

19. A battery separator according to claim 18, wherein the polyolefin is polyethylene and/or polypropylene.

20. A battery separator according to claim 1, wherein the fibrous layer has a thickness of 0.2 mm to 3.6 mm.

21. A battery separator according to claim 1, wherein the openings of the support layer cover more than 60 % of the surface of the support layer.

22. A battery separator according to claim 21, wherein the openings of the support layer cover more than 70 % of the surface of the support layer.

23. A battery separator according to claim 22, wherein the openings of the support layer cover more than 80 % of the surface of the support layer.

24. A battery separator according to claim 23, wherein the openings of the support layer cover more than 90 % of the surface of the support layer.

25. A battery separator according to claim 1, wherein the openings are spaced apart 0.01 to 5 mm.

26. A battery separator according to claim 1, wherein the support layer basically consists of a filled or unfilled polymer.

27. A battery separator according to claim 26, wherein the polymer is a thermoplastic polymer.

28. A battery separator according to claim 26, wherein the polymer is a polyolefin.

29. A battery separator according to claim 28, wherein the polyolefin has a molecular weight of at least 600,000, a standard load melt index of substantially 0, and a viscosity number of not less than 600 ml/g.

30. A battery separator according to claim 28, wherein the polyolefin is polyethylene.

31. A battery separator according to claim 26, wherein the support layer is a microporous polymer layer with an average pore size of less than 1 µm.

32. A battery separator according to claim 31, wherein more than 50 % of the micropores of the microporous polymer layer are 0.5 µm or less in diameter.

33. A battery separator according to claim 1, wherein at least two opposing edge regions of the support layer are not covered by the fibrous layer to provide edges for sealing.

34. A battery separator according to claim 1, wherein the openings of the support layer have a greatest possible diameter of more than 1 mm.

35. A battery separator according to claim 1, wherein the openings of the support layer have the form of slots or long holes.

36. A battery separator according to claim 1, wherein the support layer basically consists of a glass fiber fabric.

37. A battery separator according to claim 1, wherein the support layer basically consists of a polymer fiber fabric.

38. A battery separator according to claim 1, wherein the support layer basically consists of a polymer fiber fleece layer.

39. A battery separator according to claim 1, wherein the support layer basically consists of a fleece layer containing polymer fibers and glass fibers.

40. A battery separator according to claim 1, wherein the support layer has a thickness of 0.01 to 1 mm.

41. A battery separator according to claim 1, wherein the separator has the form of a pocket with an open top, a closed bottom and closed sides.

42. A valve-regulated lead-acid battery comprising at least two oppositely charged electrodes in a closed case, a body of an electrolyte and a separator between adjacent ones of said electrodes, wherein said separator is a separator according to claim 1.